

What is claimed is:

1. A rotary cone bit comprising:
a steel bit body comprising at least one leg extending therefrom;
5 a steel cone rotatably disposed on the leg, the cone comprising a plurality of cutting
elements projecting outwardly therefrom;
wherein one or more of the cutting elements comprises a steel base portion projecting
outwardly a distance from the cone, and an end portion attached to the base and extending
therefrom to a tip of the cutting element, the end portion comprising a wear resistant surface
10 made by the process of:
combining powders selected from the group consisting of carbides, borides,
nitrides, carbonitrides, refractory metals, cermets, Co, Fe, Ni, steel, and combinations
thereof, to form a material mixture;
shaping the material mixture into the form of the end portion; and
15 applying the formed material mixture onto the base when the base is in a
pre-existing rigid state and is part of the cone.
2. The bit as recited in claim 1 wherein the end portion is substantially solid, and
wherein the end portion and the base include complementary adjacent surfaces to facilitate
20 attachment therebetween
3. The bit as recited in claim 1 wherein before the step of applying, the end
portion is pressurized under elevated temperature conditions to form the wear resistant
surface, and wherein the step of applying is provided by brazing.
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4. The bit as recited in claim 1 wherein the wear resistant surface has a material
microstructure comprising:
a first phase of grains that are selected from the group of carbides, borides, nitrides,
and carbonitrides of W, Ti, Mo, Nb, V, Hf, Ta, and Cr refractory metals, carbides; and
30 a second phase of a binder material selected from the group consisting of Co, Ni, Fe,
and alloys thereof.
5. The bit as recited in claim 4 wherein the wear resistant surface comprises
cemented tungsten carbide.
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6. A rotary cone bit comprising:
a steel bit body comprising at least one leg extending therefrom;

a steel cone rotatably disposed on the leg; and
a plurality of teeth projecting outwardly away from the cone, at least one tooth comprising a steel base portion integral with the cone and projecting a distance therefrom, and a substantially solid end portion extending from the base portion to an opposite tip of the tooth, the base and end portions being permanently attach together, the end portion being
5 formed from a wear resistant material having a microstructure comprising:
a first phase of grains selected from the group of carbides, borides, nitrides, and carbonitrides of W, Ti, Mo, Nb, V, Hf, Ta, and Cr refractory metals; and
a second phase of a binder material selected from the group consisting of Co,
10 Ni, Fe, and alloys thereof.

7. The bit as recited in claim 6 wherein the tooth base and end portion include interface surfaces comprising complementary attachment means for facilitating attachment therebetween.

8. The bit as recited in claim 7 wherein the end portion includes a base interface surface opposite from the tip and an attachment member projects outwardly therefrom, and the base includes an end portion interface surface comprising an attachment recess disposed therein for accommodating placement of the attachment member therein.

9. The bit as recited in claim 6 wherein the wear resistant composite material is WC-Co.

10. A method for providing a wear resistant material onto a cutting element projecting from a rotary cone of a milled tooth bit comprising the steps of:
25 combining powders selected from the group consisting of carbides, borides, nitrides, carbonitrides, refractory metals, cermets, Co, Fe, Ni, steel, and combinations thereof to form a material mixture;
shaping the material mixture into the form of an end portion of the cutting element,
30 wherein the cutting element includes a steel base that is integral with and that projects outwardly a distance from the rotary cone, the end portion being substantially solid and comprising a tip at one and a base interface surface at an opposite end;
pressurizing the end portion under conditions of elevated temperature to form the wear resistant material; and
35 attaching the end portion to the base by brazing process.